How Does the Math Work?

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precisionlender

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Overview

- How do we calculate:
  - Loan Profitability
  - Deposit Profitability
  - Other Fee Profitability
  - Return on Equity (Putting it all together)
- Engine Resources

Loan Profitability

Includes:

- Interest Income
- Interest Expense & Match Funding
- Non-Interest Expense
- Lines of Credit
- Interest Rate Swaps
- Factoring in Risk
  - Loan Loss Reserve: Adjusting Returns for Expected Loss
  - Capital: Allocating Economic Capital for Unexpected Loss
  - Risk Mitigants: Collateral & Guarantees
  - Loss Given Default and Probability of Default
- Taxes and Tax-Exempt Loans
- Conversion Loans and Rate Locks
- Floating Rate Loan with Floor/Cap

Loan Profitability - Example

	Loans
Interest Income	$51,999
Interest Expense	$25,980
Net Interest Income	**$26,019**
Non-Interest Expense	$2,076
Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$21,545**
Taxes	$4,524
Net Income	**$17,021**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

- $1MM Commercial Real Estate
- 5 Year Maturity/ Term
- Interest Only
- 5 year term on the funding curve is 2.598% (funding cost)
- 5.375% Interest Rate (Actual/360)
- No Origination Fee

Loan Profitability – Interest Income

	Loans
Interest Income	$51,999
Interest Expense	$25,980
Net Interest Income	**$26,019**
Non-Interest Expense	$2,076
Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$21,545**
Taxes	$4,524
Net Income	**$17,021**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

Main Inputs:

- Interest Rate (5.375%)
- Interest Rate Basis (Actual/360)
- Origination Fees ($0)
- Origination Expenses ($12,487)
- Term (60 months)
- Average Balance ($1,000,000)

Interest Income is:

- [Initial Interest Rate] x
- [Adjustment for Interest Rate Basis] x
- [Average Balance] +
- [Origination Fees – Origination Expenses, Annualized over the Term]

Specifically in this Example:

- 5.375% x (365/360) x $1,000,000 + ($0 - $12,487) x (12/60)
- = $51,999

Loan Profitability – Interest Income Tax Exempt

	Loans
Interest Income	$51,999
Interest Expense	$25,980
Net Interest Income	**$26,019**
Non-Interest Expense	$2,076
Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$21,545**
Taxes	$4,524
Net Income	**$17,021**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

Main Inputs:

- Interest Rate (4.355%[1]) Bank Qualified Tax Exempt
- Federal Tax Rate 21.0%, 0% State Tax
- Interest Rate Basis (Actual/360)
- Cost of Funds (2.598%)
- Interest Deduction (20%)
- Origination Expenses ($12,487)

Interest Income is (with 0% State Tax Rate):

- ([Initial Tax Exempt Interest Rate] less
- [Cost of Funds x Interest Deduction x Tax Rate]) divided by (1 – Tax Rate) x [Adjustment for Interest Rate Basis] x
- [Average Balance] +
- [Origination Fees – Origination Expenses, Annualized over the Term]

Specifically in this Example:

- {(4.354%-[2.598% x 20% x 21%)/(1- 21.0%)} x (365/360) x $1,000,000 + ($0 - $12,487) x (12/60) = $51,999

1. Interest Rate floating decimal is 4.35536%

Loan Profitability – Interest Expense

	Loans
Interest Income	$51,999
Interest Expense	$25,980
Net Interest Income	**$26,019**
Non-Interest Expense	$2,076
Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$21,545**
Taxes	$4,524
Net Income	**$17,021**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

Main Inputs:

- Yield/Funding Curve
- Term Structure[1] (60 months)
- Average Equity (Capital) ($88,662)[2]
- Average Balance ($1,000,000)

Interest Expense is:

- ([Average Balance][3] x
- [Funding Curve Value at 60 months])

Specifically in this Example:

- $1,000,000 x 2.598% = $25,980

1. Because the example is an Interest Only loan, there is a single repayment at the 60 month term. See the Matched Funding discussion on the following slide.
2. An alternative method is to include capital as part of the funding, in that case the equation becomes ([Average Balance – Average Equity] x [Funding Curve Value at 60 months]). But this method is not recommended.
3. Average Balance is weighting the monthly balances over the term of the loan

Loan Profitability Calculations – Match Funding

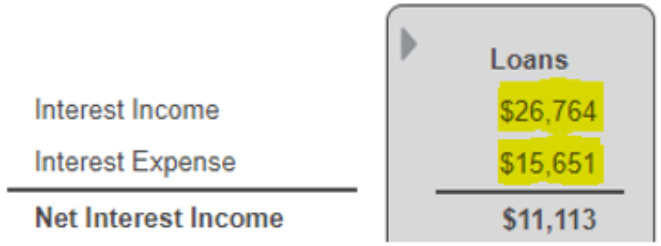
- **Based on a "marginal opportunity cost of funds" funding curve (in our example we use a composite of the publicly available FHLBs)**
  - PrecisionLender allows you to use any funding curve that you choose. However, we recommend using a "marginal market opportunity cost of funds," such as the FHLB pt 3-month Libor/Swap or FHLB. This captures the opportunity cost of other investment options (e.g. risk-free municipal bonds etc.).
- **Sometimes called "match funding or strip funding" it's used to allocate Interest Expense in a way that is "interest rate risk neutral."**
- **Each principal repayment has a re-pricing duration and is match funding separately**
  - A 60 month fixed rate interest only loan will be funded with 60 month money (only one repayment)
  - A 60 month fixed rate amortizing with monthly payments will be funded as a set of 60 separate interest only loans each maturing with the principal repayment in month 1, 2,3…60
- **Adjustable Rate loans (e.g. a 36/12, 60/12, 36/36 etc.) are treated as if the loan repays and is re-funded at each adjustment so a 36/12 will be funded with 36 month money and then 12 month money**
- **Floating rate loans are considered to re-price monthly and therefore will fund off the shortest duration on the Funding Curve**
  - Interest Expense might be adjusted by a Liquidity Premium based upon the term of the floating rate obligation

Loan Profitability Calculations – Match Funding cont'd

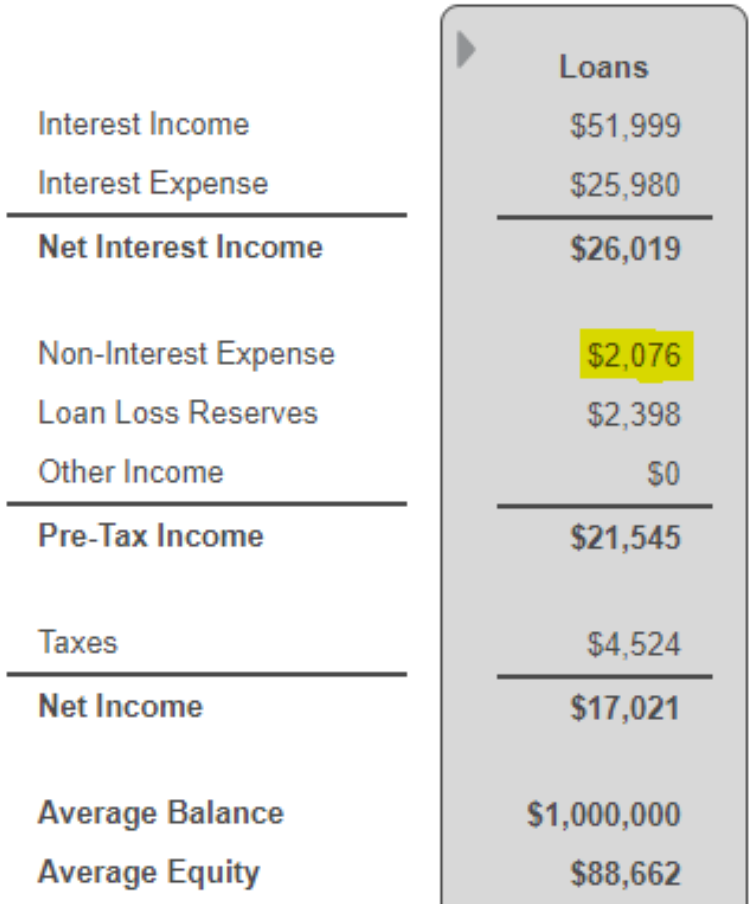
(Match Funding is sometimes referred to as "Strip Funding")

- The table to the right shows the calculation of monthly Interest Expense for a 12 month fully amortizing 5.375% commercial real estate loan.
- The FHLB Curve for the one to twelve month interest rates are based on an actual/360 day basis, this is adjusted by 365/360, see column C.
- Column D shows the principal repayment.
- Column E shows the monthly interest associated with each principal payment.
- Column F is the sum of these payments through the time period, i.e. the costs in Month 1 is sum of Month 1 to Month 12, while Month 6 is the sum of Month 6 to Month 12.

A	B	C	D	E	F
Month	FHLB Curve	FHLB Curve Adjusted	Principal Repayment	Interest for monthly repayment	Monthly COF
1	2.698%	2.735%	$ 81,244	$ 185.20	$ 2,359.76
2	2.710%	2.748%	$ 81,618	$ 186.88	$ 2,174.56
3	2.723%	2.761%	$ 81,994	$ 188.64	$ 1,987.68
4	2.740%	2.778%	$ 82,371	$ 190.69	$ 1,799.04
5	2.759%	2.797%	$ 82,751	$ 192.90	$ 1,608.35
6	2.781%	2.820%	$ 83,132	$ 195.33	$ 1,415.45
7	2.801%	2.840%	$ 83,514	$ 197.64	$ 1,220.11
8	2.822%	2.861%	$ 83,899	$ 200.04	$ 1,022.47
9	2.851%	2.891%	$ 84,285	$ 203.03	$ 822.43
10	2.870%	2.910%	$ 84,673	$ 205.32	$ 619.40
11	2.871%	2.914%	$ 85,063	$ 206.56	$ 414.08
12	2.871%	2.914%	$ 85,455	$ 207.51	$ 207.51
			$ 1,000,000		$ 15,650.85



Loan Profitability – Non-Interest Expense



	Loans
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Net Income	**$17,021**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

Main Inputs:

- Annual Servicing Expense
- Percent of Average Balance - Servicing
- Percent of Amount - Servicing
- Annual Fees
- Equity Credit
- Average Capital
- Participation Fees and Expenses

Non-Interest Expense is:

- [Annual Servicing Expense]+[Percent of Average Balance x Average Balance] +[Percent of Amount x Amount] + [Percent of Net Interest Income x Net Interest Income] –[Annual Fees] – [Equity Credit x Average Capital]–[Participation Servicing Fees] + [Participation Servicing Expense]

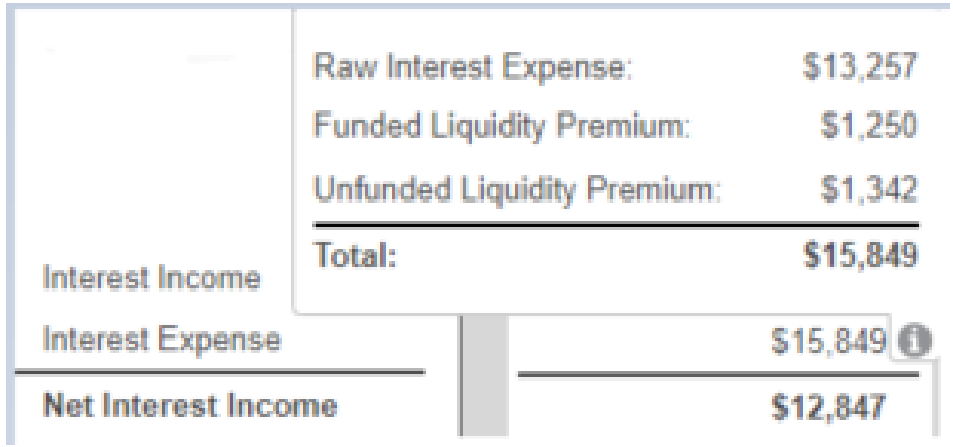
In this Example:

- $2,076 + 0.0% X $1,000,000 + 0.0% X $1,000,000 - $0 - $0.0 * $88,665 - $0 + $0 = $2,076

Lines of Credit

- While the calculation of interest income is like that discussed in the previous slide, interest expense may differ for a line of credit.
- There are two components, the calculation for the funded portion and for the committed but unfunded portion.
- Typically a line of credit uses a floating rate type, as such a liquidity premium may be charged on the funded portion.
- Assume a $1 million committed line that is 50% used for a 36-month term.

Loan Profitability –Interest Expense (Line of Credit)



Main Inputs:

- Yield/Funding Curve
- Liquidity Premium Curve[1]
- Term Structure (36 months)
- Unusued Line Opportunity Cost Option[2]
- Transfer Duration
- Unfunded Liquidity Factor
- Commitment ($1,000,000)
- Average Usage Percentage

Interest Expense is:

- ([Commitment x Usage Percentage] x
- [Funding Curve Value at 0 or 1 month + Liquidity Premium at 36 months]) +
- ([Commitment x (1-Usage Percentage)] x
- [Funding Curve Value at Transfer Duration (1 month) x Unfunded Liquidity Factor(10%)])

Specifically in this Example:

- ($1,000,000 x 50% x [2.615%x(365/360)[3] + 0.25%[4]]) + ($1,000,000 x [1 -50%] x 2.648%*(365/360) x 10%) = $15,859

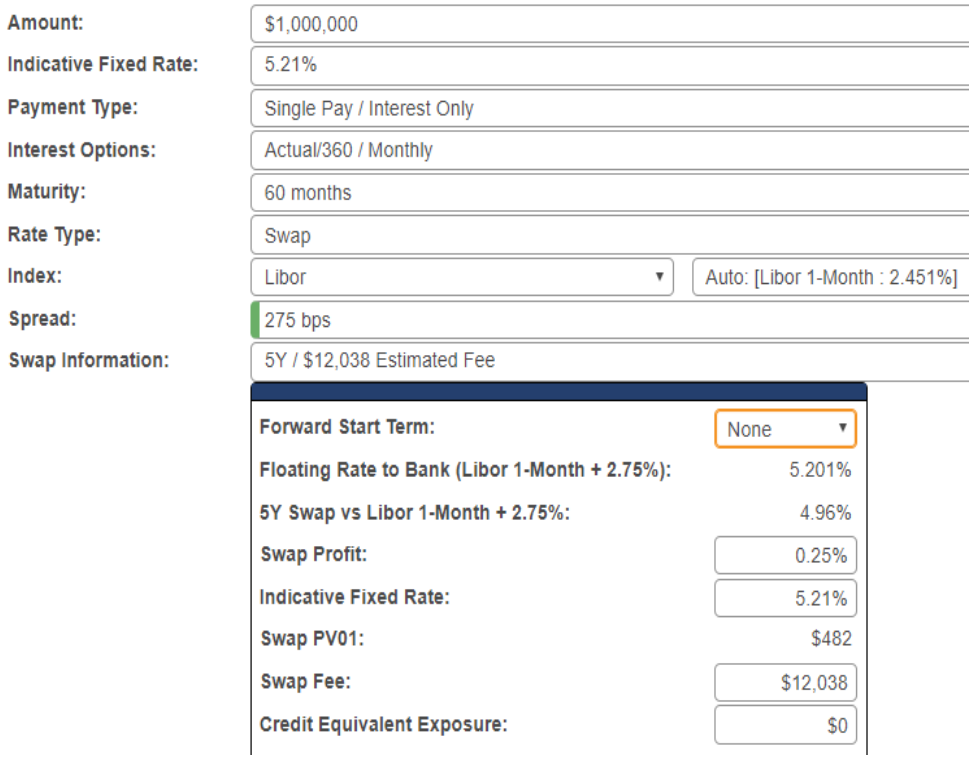
1. Interest expense for a floating rate loan includes a rate from the liquidity premium curve (if available) based on the term of the loan/line.
2. Precision Lender provides several options for unused opportunity cost, this example demonstrates the point of the curve method.
3. Interest rates under 13 months adjusted by 365/360.
4. Liquidity Premium Curve at 36 months in this example is 0.25%

Interest Rate Swaps

- Various Rate Types can be used with PrecisionLender, including Fixed rate, Floating rate and Adjustable Rate.

- In addition "Back to Back" or "One Way" Interest Rate Swaps can be modelled on PrecisionLender, where the bank can receive a floating rate while the client can be assured a fixed rate.

Interest Rate Swaps



Main Inputs:

- Rate Type – Swap
- Swap Floating Rate Index – Libor
- Spread – 275 basis points
- Swap Profit (Fee) – 25 basis points

Calculations:

- Based on Pricing Terms provided by a PL Swap provider (Chatham Financial, Derivative Path , Raymond James, etc.)
- In this example the Swap PV01 is $482 per basis point
- The Indicative Fixed Rate in this example is 5.21% (the borrowers fixed rate), the bank would receive 1-month Libor plus 275 bps
- All profitability calculations are based on a floating rate at 1-month Libor plus 2.75%.

Loan Profitability Calculations – Factoring in Risk

PrecisionLender allows you a range of options on how to factor in risk. PrecisionLender uses a more comprehensive (Basel III–style) multi-factor approach. A second approach is also available using assumptions on Probability of Default (PD) and Loss Given Default (LGD) also called 2DRR. One can also use different assumptions for the products or different products within different regions. The next seven slides relate to the Multi-Factor method. In slides 23 to 27 there will be a discussion of the PD/LGD method. An institution will only use one of these two methods. The reader can skip the section that does not apply to their institution.

Multi-Factor and PD-LGD Approaches

- Loan Loss Reserve and Credit Capital are based on multiple risk factors:
  - Risk Rating for the borrower (the borrower Probability of Default or PD)
  - The size of the Exposure at Default (EAD)
  - Collateral and guarantees (these affect the Loss Given Default or LGD)
- Loan Loss Reserve and Credit Capital can also be varied by the duration of the exposure for each risk rating.

Loan Profitability – Multi-Factor Risk (1 of 7)

	Loans
Interest Income	$51,999
Interest Expense	$25,980
Net Interest Income	**$26,019**
Non-Interest Expense	$2,076
Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$21,545**
Taxes	$4,524
Net Income	**$17,021**
Average Balance	**$1,000,000**
Average Equity	**$88,662**
Avg Regulatory Capital	**$80,000**
Avg Economic Capital	**$71,943**

Main Inputs:

- Borrower Risk Rating
- Average Balance
- Term Structure[1]
- Type and Value of Collateral
- Type and Amount of Guarantees
- Minimum or Regulatory Capital Requirement

Loan Loss Reserve is:

- [Annual Loss (based on Risk Rating and Term)] x [Adjusted Exposure at Default[2]]

Average Economic Capital is:

- ([Credit Capital (based on Risk Rating and Term)] x [Adjusted Exposure at Default[2]] +[Unmitigatable Capital[3]]) x [Average Balance]

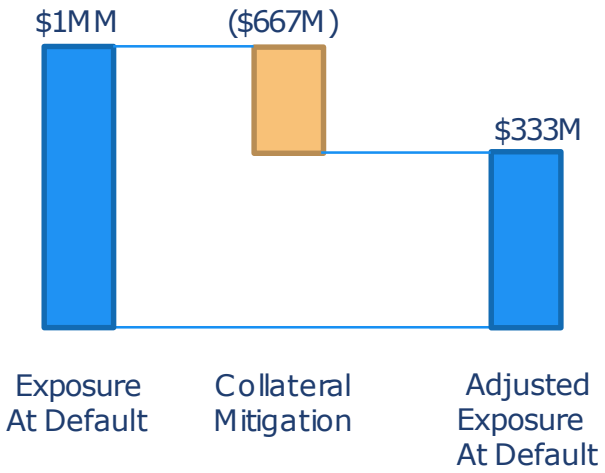
1. Because the example is an Interest Only loan, there is a single repayment at the 60-month term. Term affects the duration of the exposure and you can vary Annual Loss and Credit Capital by duration.

2. Adjusted Exposure at Default is covered in the next slide.

3. Unmitigable Capital is the total Operational & Market Risk Capital. It does not vary with Risk Rating or duration.

Loan Profitability – Multi-Factor Risk (2 of 7)

When using a multi-factor risk approach in PrecisionLender, the lender specifies the type(s) and amount(s) of collateral. Each type of collateral has a Recovery Factor defined. The Recovery Factor is the ratio of the present value of the recovered collateral after expenses as a percentage of the nominal collateral value.



Collateral Exposure Mitigation:

- 75% LTV ($1.33MM Collateral Value)
- 50% Economic Recovery Rate[1]
- =(50%) x ($1.33MM) =$666,667

Adjusted Exposure at Default:

- (Exposure at Default) – (Collateral Exposure Mitigation)
- =$1,000,000 – $666,667 =$333,333

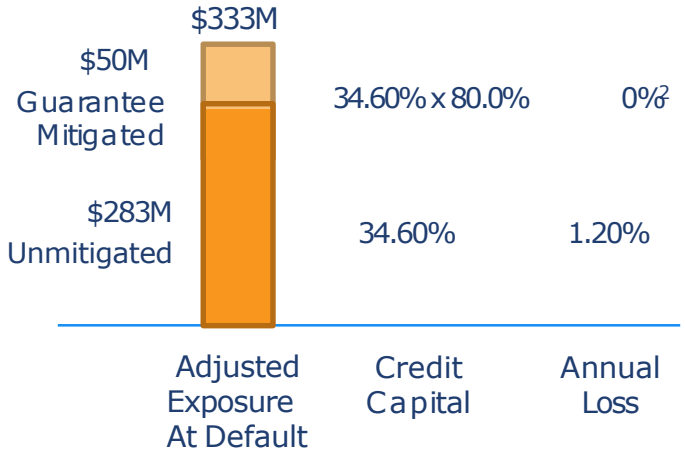
Example (before effects of Guarantee and time)[2]:

- Loan Loss Reserve =$ 333,333 x 1.20% =$4,000
- Average Equity =$ 333,333 x 34.6% +$1,000,000 x 1% =$125,333[3]

1. Each type of collateral type has its own Recovery Rate and a loan can have multiple layers of collateral. For example, the collateral above is Commercial Real Estate and has a 50% Recovery Rate. A CD held at the bank would have a 95% recovery rate (and therefore is worth more as a mitigant for the same dollar amount).
2. Here we show that the assumed Annual Loss (1.20%) and the Credit Capital (34.60%) are based on the exposure not covered by collateral or guarantees at a 60-month term.
3. This includes unmitigated risk (operational and market) assumed at 1% of the monthly loan balance (EAD)

Loan Profitability – Multi-Factor Risk (3 of 7)

When using a multi-factor risk approach in PrecisionLender, the lender can specify the type(s) and amount(s) of guarantees. Each guarantee has a Recovery Factor defined that operates like the collateral Recovery Factor. In addition, each guarantee can have additional origination and servicing expenses associated with it. Finally, guarantees can either be risky guarantees (e.g. a personal or corporate guarantee) or considered riskless (such as a government guarantee). Riskless guarantees operate just like collateral except with additional expenses. Guarantees do not affect the Adjusted Exposure at Default, but instead affect how capital and annual loss are applied.



Guarantee Mitigation:

- $1,000,000 Personal Guarantee
- Guarantor is a "4" Risk Rating and that Risk Rating has a 80.0% Guarantee Factor[1]
- 5% Economic Recovery Rate
- Obligor Is a "4" Risk Rating and has a Credit Capital rate of
- 34.6% (for a 60 month duration)
- =5% x $1,000,000 =$50,000 of Guarantee mitigation

Loan Loss Reserves:

- [Unmitigated Exposure] x [Annual Loss]
- $283,333 x 1.20% + (50,000 x 1.2% x 1.2%)= $3,407[3]

Average Equity (Capital) before time factor:

- [Guarantee Mitigated Exposure] x [Credit Capital Rate] x [Guarantee Factor[2]] [3] +[Unmitigated Exposure] x [Credit Capital Rate]
- $50,000 x 34.60%X 80.00% +$283,333 x 34.60% + $1,000,000 x 1.00%= $121,873[4]

1. Each Risk Rating has a Guarantee Factor as an assumption. This approach is taken from the Basel III approach to guarantees.
2. This factor is determined solely by the guarantor's Risk Rating and is then multiplied by the obligor's Credit Capital.
3. We assume obligator and facility loan loss percentage is the same.
4. This would be for the first month of the loan, there is a calculation for each month where the exposure value would decline with time particularly on amortizing loans.

Loan Profitability – Multi-Factor Risk (4 of 7)

The Credit Capital, Loan Loss and Guarantor factors change over time. This reflects the normal observation that loans of the same risk rating with a shorter term represent less overall risk than those of a longer duration.

- As part of the creditmigration using Basel III analysis, the bank will determine the credit capital[1], loan loss and Guarantor factors based on different durations of a loan.
- The table to the right shows that a loan with five years to maturity would have a credit capital rate of 34.60%. At one year this declines to 8.50%.
- The three-year level would be 22.09%, is the interpolations between the one- and five-year durations.
- The second table shows the change in credit capital over time and capital requirements.

Duration	Annual Loss	Credit Capital	Guarantor Factor
12	0.6%	8.5%	80.0%
60	1.2%	34.6%	80.0%
120	1.55%	48.3%	94.0%
For all	1.55%	48.3%	94.0%

Month	Exposure at Default	Guarantee Coverage	Guarantee Factor	Credit Capital	Credit Capital	Unmitigated	Total Economic Capital
1	$333,333	$50,000	80.00%	34.60%	$111,873	$10,000	$121,873
2	$333,333	$50,000	80.00%	34.06%	$110,115	$10,000	$120,115
3	$333,333	$50,000	80.00%	33.51%	$108,357	$10,000	$118,357
4	$333,333	$50,000	80.00%	32.97%	$106,599	$10,000	$116,599
5	$333,333	$50,000	80.00%	32.43%	$104,841	$10,000	$114,841
6	$333,333	$50,000	80.00%	31.88%	$103,083	$10,000	$113,083
24	$333,333	$50,000	80.00%	22.09%	$71,436	$10,000	$81,436
25	$333,333	$50,000	80.00%	21.55%	$69,678	$10,000	$79,678
26	$333,333	$50,000	80.00%	21.01%	$67,920	$10,000	$77,920
27	$333,333	$50,000	80.00%	20.46%	$66,162	$10,000	$76,162
40	$333,333	$50,000	80.00%	13.39%	$43,306	$10,000	$53,306
41	$333,333	$50,000	80.00%	12.85%	$41,548	$10,000	$51,548
42	$333,333	$50,000	80.00%	12.31%	$39,790	$10,000	$49,790
43	$333,333	$50,000	80.00%	11.76%	$38,032	$10,000	$48,032
60	$333,333	$50,000	80.00%	8.50%	$27,483	$10,000	$37,483
average					$61,943	$10,000	$71,943

1. The approach taken on the determination of the credit capital factor and annual loss is consistent with the **Basel III approach** as outlined in the International Convergence of Capital Measurement and Capital Standards (A Revised Framework Comprehensive Version).

Minimum (Regulatory) Capital Requirements (5 of 7)

- The bank can also specify a minimum regulatory capital requirement that must be met each month of the loan. This is set as a percentage of the monthly loan balance.
- This minimum can vary by risk rating.
- In the determination of ROE, a bank can specify that the capital used in the denominator of the ROE equation is:
  - The greater of each month's economic capital or the minimum capital level
  - The Regulatory or Minimum Capital only (Assume 8% in the example pictured), or
  - The Economic Capital, only.
- A minimum monthly Loan Loss can also be set.

Month	Economic Capital	Regulatory	Total Capital
1	$121,873	$80,000	$121,873
2	$120,115	$80,000	$120,115
3	$118,357	$80,000	$118,357
4	$116,599	$80,000	$116,599
5	$114,841	$80,000	$114,841
6	$113,083	$80,000	$113,083
24	$81,436	$80,000	$81,436
25	$79,678	$80,000	$80,000
26	$77,920	$80,000	$80,000
27	$76,162	$80,000	$80,000
40	$53,306	$80,000	$80,000
41	$51,548	$80,000	$80,000
42	$49,790	$80,000	$80,000
43	$48,032	$80,000	$80,000
60	$37,483	$80,000	$80,000
	$71,943	$80,000	$88,662

Line of Credit Profitability –Multifactor Risk (6 of 7)

While calculation of capital is similar for a line of credit with other loan types, the method used to determine EAD is different.

- The EAD used in Economic Capital is the product of the Commitment Amount and the Average Usage Percentage plus the product of Unfunded amount (Commitment Amount times 1 –Average usage Percentage) and the expected Usage Given Default percentage (UGD) for the risk rating associated with the loan . Note UGD can vary with the risk rating, it is usually close to 100% for the strongest credit and may be 0% for the weakest.

- In the determination of Regulatory capital the minimum capital rate is multiplied by the product of the Commitment Amount and the Average Usage Percentage plus the product of Unfunded amount and a credit conversion factor. This factor is 20% for lines with an original maturity of 12 months and less otherwise 50%. If the line of credit is cancellable by the bank (demand line) the credit conversion factor is 0%.

Line of Credit Profitability –Multifactor Risk (7 of 7)

	Operating Line of Credit
Interest Income	$28,696
Interest Expense	$15,849
Net Interest Income	**$12,847**
Non-Interest Expense	$1,423
Loan Loss Reserves	$1,056
Other Income	$0
Pre-Tax Income	**$10,369**
Taxes	$2,177
Net Income	**$8,191**
Average Balance	$500,000
Average Equity	$60,000
Avg Regulatory Capital	$60,000
Avg Economic Capital	$27,047

Main Inputs:

- Average Usage Percentage (50%)
- Minimum Capital Rate (8%)
- Usage Given Default (50%)
- Term (36 months)
- Commitment ($1,000,000)

Regulatory Capital is:

- [Commitment] x [Average Usage Percentage] x
- [Capital Rate] +
- [Commitment] x [1-Avg Usage Percentage] x
- [Credit Conversion Factor] x
- [Capital Rate]

Specifically in this Example:

- [$1,000,000 x 50% x 8%] + [$1,000,000 x (1- 50%) x 50% x 8%]= $60,000

Loan Profitability – PD-LGD Capital Risk (1 of 5)

The second method to determine capital and loan loss is the use of Probability of Default and Loss Given Default.

When using the PD-LGD risk approach (sometimes referred to as 2DRR) in PrecisionLender, the Relationship Manager (lender) specifies a risk rating (there is an associated PD set by the bank) and the LGD associated with the loan opportunity. There may be a facility category that can be selected that contains an associated LGD. The determination of the LGD is usually calculated in a separate system based on the amount and type of collateral and guarantees. If your institution uses the Multi-factor method, you can skip this section.

Loan Profitability – PD-LGD Capital Risk (2 of 5)

Non-Interest Expense	$2,076
Loan Loss Reserves	$1,998
Other Income	$0
Pre-Tax Income	**$22,135**
Taxes	$4,648
Net Income	**$17,487**
Average Balance	**$1,000,000**
Average Equity	**$89,787**
Avg Regulatory Capital	**$80,000**
Avg Economic Capital	**$73,794**

Main Inputs:

- Borrower Risk Rating
- Average Balance
- Term Structure[1]
- Facility Category or Loss Given Default Group
- Minimum or Regulatory Capital Requirement

Loan Loss Reserve is:

- [Probability of Default(based on Risk Rating and Term)] x [Loss Given Default] x [Exposure at Default]
- A sum of each individual month's loan loss reserve rate.

Average Equity (Capital) is:

- ([Credit Capital % (based on Probability of Default and Term) [2]] x [Loss Given Default] x [Exposure at Default] + [Unmitigatable Capital[3]]) x [Average Balance]

1. Because the example is an Interest Only loan, there is a single repayment at the 60 month term. Term affects the duration of the exposure and you can vary Annual Loss and Credit Capital by duration.
2. In some cases, the borrower's revenues can affect the percentage.
3. Unmitigatable Capital is the total Operational & Market Risk Capital. It does not necessarily vary with Risk Rating or duration.

Loan Profitability – PD-LGD Capital Risk (3 of 5)

Non-Interest Expense	$2,076
Loan Loss Reserves	$1,998
Other Income	$0
Pre-Tax Income	**$22,135**
Taxes	$4,648
Net Income	**$17,487**
Average Balance	**$1,000,000**
Average Equity	**$89,787**
Avg Regulatory Capital	**$80,000**
Avg Economic Capital	**$73,794**

Loan Loss Reserve is:

- Average $1,000,000 x .060% x 33.3% = $1,998

Average Regulatory Capital:

- Discussion about Minimum or Regulatory capital can be found on slide 20, calculations are the same with either Economic Capital method used.
- Since this is an Interest Only Loan with an 8% minimum capital requirement the amount is $1,000,000 x 8% = $80,000

Loan Profitability – PD-LGD Capital Risk (4 of 5)

The Credit Capital and Loan Loss (PD) factors change over time. This reflects the normal observation that loans of the same risk rating with a shorter term represent less overall risk than those of a longer duration.

- As part of the creditmigration using Basel III analysis, the bank will determine the credit capital [1] and loan loss based on different durations of a loan.
- The table to the right shows that a loan with five years to maturity would have a credit capital rate of 34.60%. At one year this declines to 8.50%.
- The three-year level would be 22.09%, is the interpolations between the one- and five-year durations.
- The second table shows the change in credit capital over time and capital requirements.

Duration	Annual Loss	Credit Capital
12	0.6%	8.5%
60	0.6%	34.6%
120	0.6%	48.3%

Months	Exposure at Default	Credit Capital	LGD	Credit Capital	Unmitigated and Other	Total Economic Capital	Minimum Capital	Required Capital
1	$1,000,000	34.60%	33.3%	$115,218	$10,000	$125,218	$80,000	$125,218
2	$1,000,000	34.06%	33.3%	$113,407	$10,000	$123,407	$80,000	$123,407
3	$1,000,000	33.51%	33.3%	$111,597	$10,000	$121,597	$80,000	$121,597
4	$1,000,000	32.97%	33.3%	$109,786	$10,000	$119,786	$80,000	$119,786
5	$1,000,000	32.43%	33.3%	$107,975	$10,000	$117,975	$80,000	$117,975
6	$1,000,000	31.88%	33.3%	$106,165	$10,000	$116,165	$80,000	$116,165
24	$1,000,000	22.09%	33.3%	$73,572	$10,000	$83,572	$80,000	$83,572
25	$1,000,000	21.55%	33.3%	$71,762	$10,000	$81,762	$80,000	$81,762
26	$1,000,000	21.01%	33.3%	$69,951	$10,000	$79,951	$80,000	$80,000
27	$1,000,000	20.46%	33.3%	$68,140	$10,000	$78,140	$80,000	$80,000
40	$1,000,000	13.39%	33.3%	$44,601	$10,000	$54,601	$80,000	$80,000
41	$1,000,000	12.85%	33.3%	$42,791	$10,000	$52,791	$80,000	$80,000
42	$1,000,000	12.31%	33.3%	$40,980	$10,000	$50,980	$80,000	$80,000
43	$1,000,000	11.76%	33.3%	$39,169	$10,000	$49,169	$80,000	$80,000
60	$1,000,000	8.50%	33.3%	$28,305	$10,000	$38,305	$80,000	$80,000
average						$73,794	$80,000	$89,787

1. The approach taken on the determination of the credit capital factor and annual loss is consistent with the Basel III approach as outlined in the International Convergence of Capital Measurement and Capital Standards (A Revised Framework Comprehensive Version).

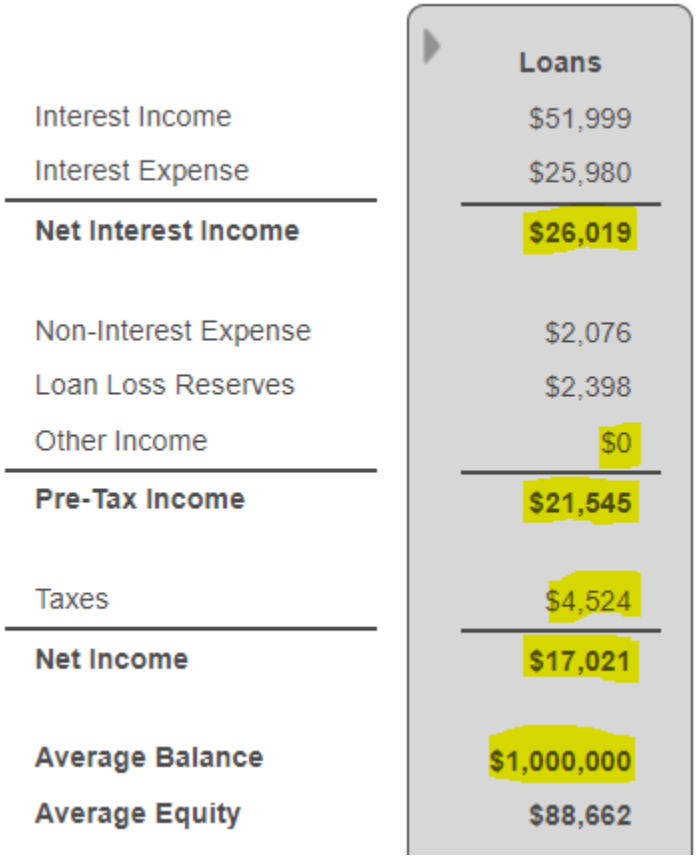
Loan Profitability – PD-LGD Capital Risk (5 of 5)

While calculation of capital is similar for a line of credit with other loan types, the method used to determine EAD is different.

- The EAD used in Economic Capital is the product of the Commitment Amount and the Average Usage Percentage plus the product of Unfunded amount (Commitment Amount times 1 –Average usage Percentage) and the expected Usage Given Default percentage (UGD) for the risk rating associated with the loan . Note: the UGD can vary with the risk rating of the loan.

- In the determination of Regulatory capital the minimum capital rate is multiplied by the product of the Commitment Amount and the Average Usage Percentage plus the product of Unfunded amount and a credit conversion factor. This factor is 20% for lines with an original maturity of 12 months and less otherwise 50%. If the line of credit is cancellable by the bank (demand line) the credit conversion factor is 0%.

Loan Profitability – Taxes & Other



	Loans
Interest Income	$51,999
Interest Expense	$25,980
Net Interest Income	**$26,019**
Non-Interest Expense	$2,076
Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$21,545**
Taxes	$4,524
Net Income	**$17,021**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

Net Interest Income:

- [Interest Income] – [Interest Expense]

Other Income:

- Not used for loans (used for Other Fee-Based Products see next slide)

Pre-Tax Income:

- [Net Interest Income] – [Non Interest Expense] – [Loan Loss Reserves] + [Other Income]

Taxes:

- [Pre-Tax Income] x ([State Tax Rate] + [Federal Tax Rate] *{1-State Tax Rate})

Net Income:

- [Pre-Tax Income] – [Taxes]

Average Balance[1]:

- The average monthly balance (average assets over the expected life) of the loan.

1. A complete month by month breakdown for all financial items can be found under the Advance Analytics area in the Amortization tab

Loan Profitability – Forward Rates

We use Implied Forward Rates as part of the match funding process whenever there is a guaranteed fixed rate on a future commitment.

Examples:

- A Construction loan that converts to Permanent Financing AND the rate on the Permanent Financing is Fixed and guaranteed at the closing of the Construction loan.
  - Example: a 12 month floating rate Construction loan that converts into a 60 month Commercial Real Estate loan with a guaranteed fixed rate. To match fund the CRE loan we "buy 72 month money" and "sell 12 month money"
- A fixed rate Construction or Land Development loan with draws scheduled in the future.

Note: we never use implied forward rates to attempt to predict rates in the future. We use them as a way to accurately match-fund and allocate Interest Expense.

Loan Profitability – Floating Rate with Floor

Raw Interest Income:	$55,764
Origination Fees:	$0
Origination Expenses:	($2,497)
Cap/Floor Impact:	$8,846
Tax Exempt Impact:	$0
Total:	**$62,113**

Interest Income	$62,113
Interest Expense	$31,013
Net Interest Income	**$31,099**
Non-Interest Expense	$2,076
Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$26,626**
Taxes	$5,591
Net Income	**$21,034**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

Example:

- $1MM Commercial Real Estate Loan
- Interest Only
- Floating Rate at Prime (5.5%) plus 0.0% (Actual/360)
- Funding Cost is the shortest duration, typically one month (2.615%) adjusted to 365/360 plus Liquidity premium of 0.45%
- No Origination Fee
- Floor of 5.75%

Loan Profitability – Floating Rate with Floor

Raw Interest Income:	$55,764
Origination Fees:	$0
Origination Expenses:	($2,497)
Cap/Floor Impact:	$8,846
Tax Exempt Impact:	$0
Total:	**$62,113**

Interest Income	$62,113
Interest Expense	$31,013
Net Interest Income	**$31,099**
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Loan Loss Reserves	$2,398
Other Income	$0
Pre-Tax Income	**$26,626**
Taxes	$5,591
Net Income	**$21,034**
Average Balance	**$1,000,000**
Average Equity	**$88,662**

Interest Income is:

- [Initial Interest Rate] x
- [Adjustment for Interest Rate Basis] x
- [Average Balance] +
- [Origination Fees – Origination Expenses, Annualized over the Term] +
- Effect of the Floor [1]

1. Floor is 5.75% which is above the current rate of Prime at 5.50% plus 0.00%. The Floor is in effect for 60 months. Black 76 model is used to determine the value of that Floor based on relative volatility assumptions. Having a Floor will increase interest income while a Cap will reduce it. See the following Support article for further details: https://support.precisionlender.com/hc/en-us/articles/206935767

Overview – Deposit Profitability

- Interest Income
- Interest Expense
- Float and Reserves
- Capital

Deposit Profitability – Financial Statement

	Deposits
Interest Income	$2,704
Interest Expense	$1,000
Net Interest Income	**$1,704**
Non-Interest Expense	$690
Loan Loss Reserves	$0
Other Income	$0
Pre-Tax Income	**$1,014**
Taxes	$213
Net Income	**$801**
Average Balance	**$100,000**
Average Equity	**$2,000**

Interest Income

- (1 - [Float & Reserves]) x [Average Balance] x [Funding Curve Transfer Rate]
- [Funding Curve Transfer Rate] is based on the duration of the deposit. For non-maturity deposits this is a part of the Product definition. For Timed Deposits, this is set by the Term of the Timed Deposit.

Interest Expense

- [Average Balance] x [Interest Rate Paid]

Non-Interest Expense

- [Average Annual Operating Expense] - [Average Annual Fee Income]

Average Balance

- The average monthly balance (average assets over the expected life) of the deposit.

Average Equity

- [Average Balance] x [Deposit Capital Rate]

Specifically in this Example:

- Interest Income: (1- .18%) *$100,000 *2.71% = $2,704
- Interest Expense: $100,000 * 1.00% = $1,000
- Non-Interest Expense: $692 -$2 = $690
- Average Equity: $100,000 x 2.0% = $2,000

Overview – Other Fee Profitability

- Interest Income
- Interest Expense
- Earning Credit

Fee Profitability – Product Types

- There are four fee types
  - Annual Revenue and Balance – Total average annual revenue is entered plus the expected average balance, example is wealth management
  - Annual Revenue – Only average annual revenue is entered, this amount is expected to be received over the life of the opportunity, costs of this service are entered in the Administration Section
  - Activity Based – Individual services where the average monthly expected volume is entered and the related unit revenue and unit cost are applied. Example is treasury management services
  - Expected One Time Revenue – For products where there is a one-time fee received, example is title insurance

Fee Profitability – Financial Statement

	Description	Revenue	Balance	Net Income
Cash Management	Lock Box and Other Treasury Management Service	$11,067 /yr		$4,387

	Eligible for Earnings Credit	Monthly Unit Volume: Estimated	Waived	Chargeable	Unit Price	Monthly Revenue	Monthly Expense
Lockbox Transactions	☑	250	10	240	$1.00	$240.00	$125.00
Wire Transfer	☑	15	2	13	$35.00	$455.00	$225.00
Debits	☑	525	0	525	$0.25	$131.25	$52.50
Lost Items	☑	3	1	2	$15.00	$30.00	$24.00
Deposits	☑	22	0	22	$3.00	$66.00	$33.00

Add

Wealth Management	Third party referral fees	$3,000 /yr	$0	$237

Eligible Revenue:	$11,067		
Ineligible Revenue:	$3,000		
Gross Other Revenue:	**$14,067**		
Net Revenue:	**$14,067**		
Servicing Expense:	($8,214)		
Other Income:	**$5,853**		
Non-Interest Expense		$0	$5,853
Loan Loss Reserves			
Other Income		$0	$5,853

Other Income

- For Activity Based Fee Products, monthly unit volume by product type is needed.
- For Other Fee based products, estimated annual revenue is needed (see Wealth Management above).
- Note items stated as Eligible Revenue are those that earning credits can cover

Other Income Example

- [Unit Volume less Waived Units] x (Unit Price less Unit Expense) x (1 – tax rate)
- Sum for each activity based item (if any)
- For non-activity based product = {[Annual Revenue x (1 – Expenses as a Percent of Revenue)] – set dollar expense x (1 – tax rate)

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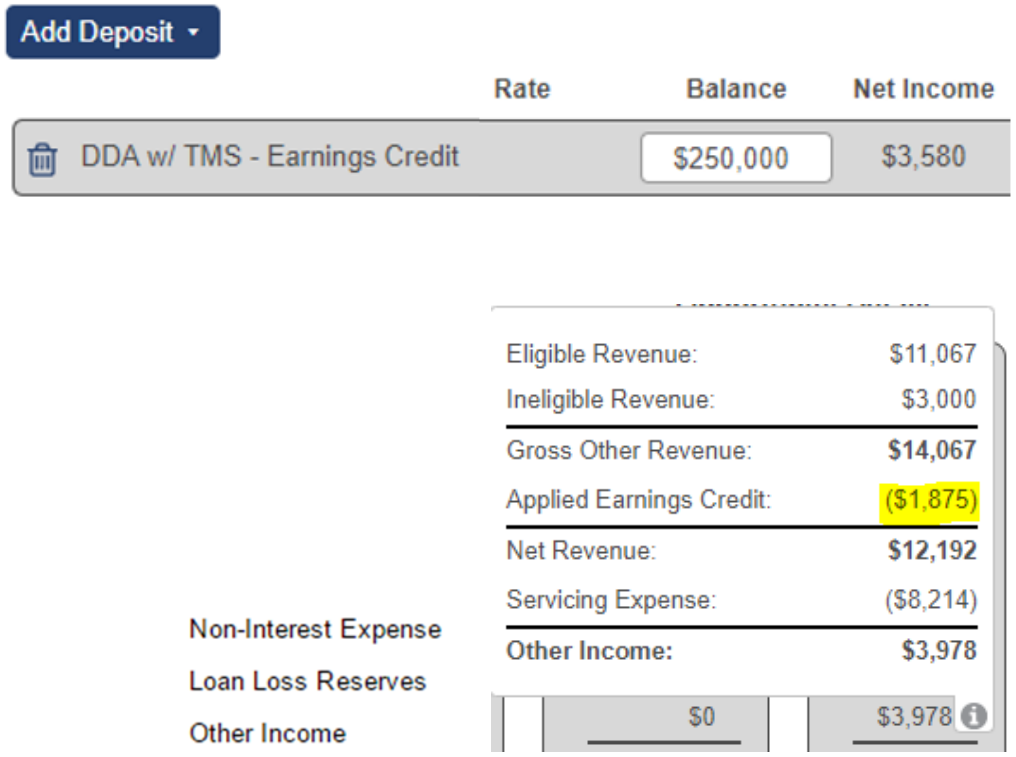
Fee Profitability – Earning Credit – Financial Statement



Earnings Credit Deposit Type

- For Activity Based Fee Products, earning credits from a deposit can be used to compensate for fees
- In Deposit Assumption, earning credit rates can be listed

Earnings Credit

- [First Balance] x (First Balance Earnings Credit Rate) + [Second Balance] x (Second Balance Earnings Credit Rate) + additional balances and credits
- ($50,000 x 0.25%) + ($100,000- $50,000) x 0.50% + ($250,000- $100,000) x 1.00% = $1,875

Fee Profitability – Financial Statement

Non-Interest Expense	$0
Loan Loss Reserves	$0
Other Income	$8,515
Pretax Income	**$8,515**
Taxes	$2,972
Net Income	**$5,543**
Average Balance	**$0**
Average Equity	**$0**

Return on Equity – Putting it All Together

- Net Income
- Capital
- Return on Equity
- Return on Assets
- Target Return on Equity and Andi

Return on Equity

- Risk Adjusted Return on Capital (RAROC) or called within PrecisionLender, Return on Equity (ROE), is a ratio with the numerator being risk adjusted net income and the denominator being risk adjusted capital, or
- ROE = Net Income / Average Equity
- The ROE of a $1 million 60-month amortizing loan with Net Income of $16,730 and Average Equity of $81,686 is ROE = $16,730/$81,686 = 20.48%

	CRE
Pre-Tax Income	$21,178
Taxes	$4,447
Net Income	$16,730
Average Balance	$923,587
Average Equity	$81,686
ROE (RAROC)	20.48%

Return on Assets

- Return on Assets (ROA), is a ratio with the numerator being risk adjusted net income and the denominator being average assets (Balances), or
- ROA = Net Income / Average Balance
- The ROA of a $1 million 60-month amortizing loan with Net Income of $16,730 and Average Balance of $923,587 is ROA = $16,730/$923,587 = 1.81%

	CRE
Pre-Tax Income	$21,178
Taxes	$4,447
Net Income	$16,730
Average Balance	$923,587
Average Equity	$81,686
ROA	1.81%

Return on Equity

- If the entire opportunity includes multiple loans, deposits and other fee sources, the opportunity ROE can be calculated similar to the ROE for the individual items weighted by their duration.
- The next example assumes 2 loans, a $1 million 60-month loan (CRE)) and a $500,000 36-month loan (C&I Install) also a $100,000 deposit and a Wealth Management account (Other Fee).

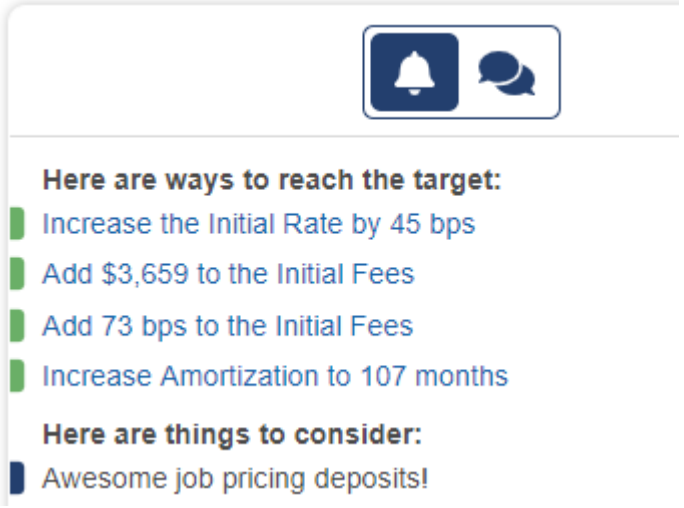
	CRE	C&I Install	All Loans	Deposit	Other Fee	Total
Pre-Tax Income	$21,178	$3,446	$23,245	$966	$253	$24,464
Taxes	$4,447	$724	$4,881	$203	$53	$5,137
Net Income	$16,730	$2,722	$18,364	$763	$200	$19,326
Average Balance	$923,587	$263,261	$1,081,544	$100,000	$0	$1,181,544
Average Equity	$81,686	$18,428	$92,743	$2,000	$0	$94,743
ROE (RAROC)	20.48%	14.77%	19.80%	38.15%		20.40%

Return on Equity

- The Net Income for all loans is weighted by the term, since the C&I Install has a term 40% shorter than the CRE (36 months compared to 60 months), its net income is adjusted by a 60% factor.
- Total Loan Net Income = CRE Net Income + 60% C&I Install or $16,730 + 60% * $2,722 = $18,364. A similar calculation is used for Average Equity.
- The All Loan ROE = $18,364 / $92,743 = 19.80%
- Deposits and most Other Fee products are assumed to last the entire term of the longest maturity loan (60 months in this example). Thus the total Net Income for the entire opportunity is: All Loans + Deposit + Other Fee = $18,364 + $763 + $200 = $19,326. A similar calculation is used for Average Equity (Note: Other Fee in this example has no Equity allocation, that is not always the case).
- The full Current Opportunity ROE is $19,326/ $94,743 = 20.40%

Target Return on Equity and Andi

- The Bank will set a target ROE for all its loan, deposit and other fee products.
- Andi will provide suggestions on meeting ROE targets if the current loan or deposit is below the level set.
- Andi's ROE target suggestions (for example, increasing Initial Rate) are the result of a deterministic process that solves for the target return.



Engine Resources

PrecisionLender Engine Standards

The PrecisionLender Engine Standards provide a detailed specification of the underlying calculations used by the PrecisionLender Engine (the "Engine"). The document serves as the minimum functional description for testing and third-party auditing to ensure that the calculations used by the Engine are performed consistently and accurately. The engine standards are available on our support site at this link: https://support.precisionlender.com/hc/en-us/articles/206935477-PrecisionLender-Engine-Standards.

Managing Risks with PrecisionLender

Commercial pricing has moved beyond static, manual solutions. Banks need a solution that's easy to configure, adjust and monitor, helping them better manage risk. That's PrecisionLender. For more information, see this article: https://support.precisionlender.com/hc/en-us/articles/4794971164947.

NOTE: Access to the engine standards and attestation report is restricted. Access can be obtained by submitting a support request or sending an email to support@precisionlender.com.